DIAGRAMS FOR SHOWING LIMITATION OF MOVEMENTS THROUGH JOINTS, AS USED BY THE BOARD OF PENSIONS COMMISSIONERS FOR CANADA

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THAT the graphic presentation of many facts is vastly more comprehensible than their verbal description needs little argument. In a picture an idea may be presented without ambiguity, and with its essential points properly emphasized. To succeed in this regard by verbal dexterity, is an art, the mastery of which is possessed by few, and by them only after long years of practise. The advantage of pictorial over verbal expression in teaching is illustrated by the predominant part played by pictures and drawings in our studies from the kindergarten to the final college year. In medicine, we remember best the teachers who used the b ackboard with facility and enthusiasm, and we are inclined to judge the text-book by the clearness and intelligibility of its illustrations.

The work of the Medical Advisory Branch of the Board of Pensions Commissioners for Canada consists in estimating, from descriptions of pathological conditions, the extent of the disablement of the individual described. To make satisfactory estimates, it is essential that these descriptions be not only accurate and comprehensive, but also clear and concise. The medical boards by whom the descriptions are written very often find great difficulty in fulfilling these requisites. This is particularly noticeable when they describe conditions where joints have suffered partial or complete ankylosis. The method usually employed is to estimate the angle at which the ankylosed joint is fixed, or the angles of its full flexion and extension if limited in motion, but the lack of uniformity, due to the divers ty of opinion regarding the angles to be measured, makes such attempts at description of very little use.

Innumerable examples might be quoted showing the difficulty of interpreting verbal descriptions by means of angles. The simplest is that of a forearm held at right angles to the upper arm by ankylosis of the elbow joint. This would generally be described as a position of ninety degrees of flexion of the forearm. But by

this some examiners would mean that the flexor surface of the forearm was at an angle of ninety degrees with the flexor surface of the upper arm, while others would mean that the extensor surface of the forearm was at an angle of ninety degrees with the position it would occupy were the forearm completely extended. It is obvious that there would be no difficulty in this case no matter which idea the examiner might have had. But if the forearm were similarly ankylosed half way between complete extension and flexion to a right angle, some examiners would describe the condition by measuring the angle between the flexor surfaces of the upper arm and the forearm and would say that the forearm was flexed to an angle of one hundred and thirty-five degrees. Others would measure the angle between normal extension and the extensor surface of the forearm and say that the forearm was flexed forty-five degrees, and still others would say that it was flexed to forty-five degrees. Each of these statements is correct. The difficulty lies in determining which angle the examiner was describing. Attempts have been made to formulate an arbitrary system by describing the angles to be measured but efforts in this direction seemed merely to add to the confusion. The instructions have been differently interpreted by different examiners and the effect of this lack of uniformity has become more and more serious as the number of cases with these conditions increased. It was early realized that some scheme of standardizing the description of these conditions was essential to the work of the medical advisers to the Pensions Board.

The first idea which occurred to me was that rubber stamps, similar to those depicting the thorax and generally used for showing graphically physical signs in the chest, might be obtained. With these it was thought that the exact degree of the limitation of movement in affected joints could be clearly shown—and the difficulties arising from verbal descriptions avoided. It was, however, found impossible to procure such stamps as were required, and the suggestion of designing stamps especially for this work was made. For this purpose some rough sketches were drawn, and, as it was discovered that there were certain disadvantages in the use of stamps, it was thought that these sketches might in an improved form be used as charts. It was then planned to make separate drawings of the skeletal structures forming each of the principal articulations and to show the point of fixation or the extent of the movement of the moving part by taking an arbitrary fixed point at the joint as the centre of a circle of which the moving part formed

the radius. On the circumference of the circle thus formed the point of fixation of the part—or the limits of its mobility could be marked. It was assumed for the sake of clearness that all movements through joints are circular and though this is not actually the case, it is sufficiently so for the purpose intended.

The point finally decided upon as the centre of the circle was that which remains constant in all the movements of the joint. In ball-and-socket joints the centre of the head of the moving bone was chosen; and in other joints the centre of the articular surface of the fixed bone.

The idea was elaborated and the draughting and printing of a complete set of diagrams was undertaken under my personal supervision. In these the fixed point is shown by a small heavy cross and the normal range of movement by an arc or a complete circle. These are subdivided into segments of one sixteenth of a circle or twenty-two and one-half degrees.

Great pains were taken to secure anatomical accuracy in the diagrams, and, though something of mathematical exactitude may have been sacrificed in showing all movements as circular, the clearness of the results has justified this assumption. The use of each diagram, of which there are thirty in all, is explained in brief on the form. These explanations have been made as concise as possible in order to avoid the loss of usefulness which not uncommonly results from long and involved instructions.

The diagrams cover all of the movements at all the joints except the temporo-maxillary. They show the outline of the body and of the skeletal structures, and include the whole of the moving part and a portion of the fixed part. In several of them the entire body is drawn. There are three showing the movements of the head on the neck, sixteen for the movements of the joints of the upper extremity, and eleven for those of the legs.

In use, these diagrams have proved not only simple but most effective. The examiner measures, with his eye, the movements or the fixed position of the limb and marks upon the circle the limits of its mobility or the point at which it is fixed. The desirability of the general use of instruments of precision for measuring angles has not yet been established to the satisfaction of the Board of Pensions Commissioners and Director General of Medical Services. Some medical boards sitting at hospitals in the larger centres are using such instruments of which simple forms are very easily improvised. With larger experience it may be found advantageous to make their use obligatory.

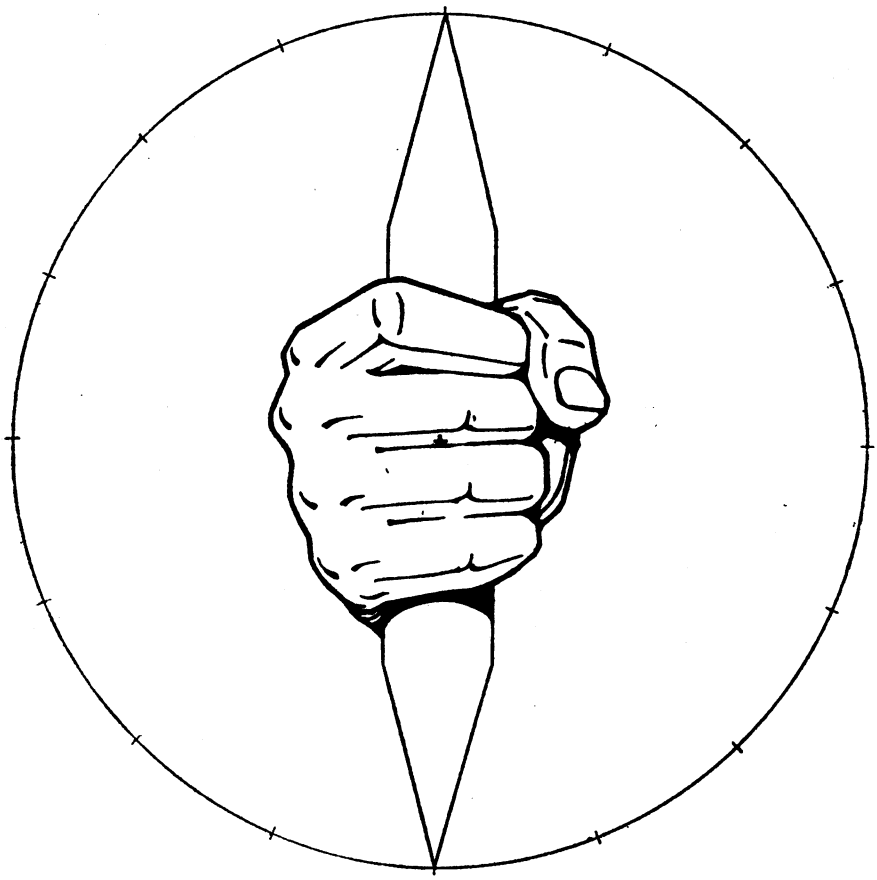
In addition to the purpose for which these diagrams were constructed, they have been found very useful in depicting the exact site and value of amputations, mutilations and serious scars, and since nearly every bone is shown in at least one of the series, a copy of radiological findings in cases where there are foreign bodies in the tissues, is by their aid easily furnished. With very little alteration they afford a graphic description of the position of and movements through false joints. These additional uses are, however, strictly subordinated to the purpose for which they are primarily intended.

A booklet is in course of preparation which will contain full instructions for the use of each diagram and will detail the additional uses to which the series may be put. This will be supplied to medical officers sitting upon boards and medical examiners for the Board of Pensions Commissioners. It is hoped that the general use of the diagrams in all cases of ankylosis and limitation of movement will result in the acquisition of a body of scientific knowledge not obtainable by any less standardized method.

Reference may be made to Fortescue Fox's "Physical Remedies for Disabled Soldiers", in which is shown a chart of somewhat similar diagrams, prepared by Dr. Cololian, of the Centre for Physical Research at Versailles.

Three of the thirty diagrams devised are published here to illustrate the principles involved.

SUPINATION AND PRONATION OF THE FOREARM



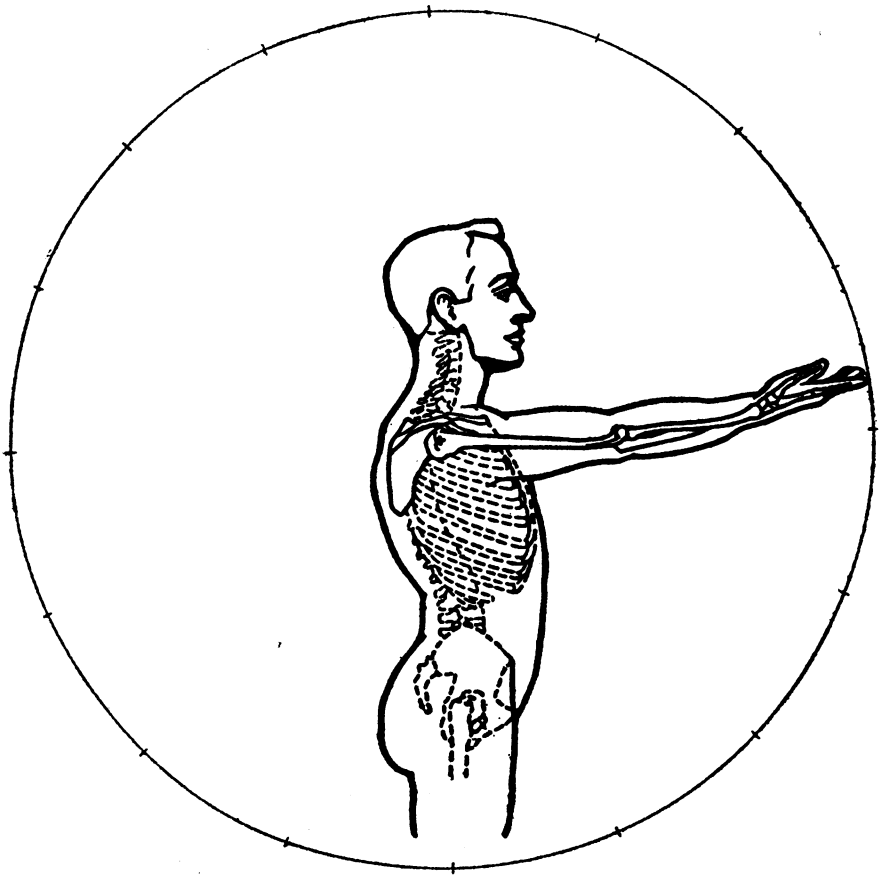
The arm should be held in position of forward elevation from the shoulder. A pencil, or similar object, to serve as an indicator, should be grasped in the closed fist so that its point will move in an arc when the forearm is rotated. Measures should be taken to prevent participation of any shoulder movement. In certain cases where shoulder movement may be a factor of importance in increasing the range of movement use one diagram to show movement in forearm solely and another in which shoulder movement is permitted, stating what each diagram is to show.

Mark with ink on the circumference of the circle in the diagram, the points indicating the position of the upper end of the pointer in extreme pronation and extreme supination (active). Join these points with an ink line following the circumference of the circle, which will then indicate the full extent of active movement.

If it is considered desirable to indicate Passive movement, also, use another diagram in the same way, stating that it shows Passive movement.

Each sub-division of the circle represents 22½ degrees or ¼ of a right angle.

CIRCUMDUCTION OF THE ARM

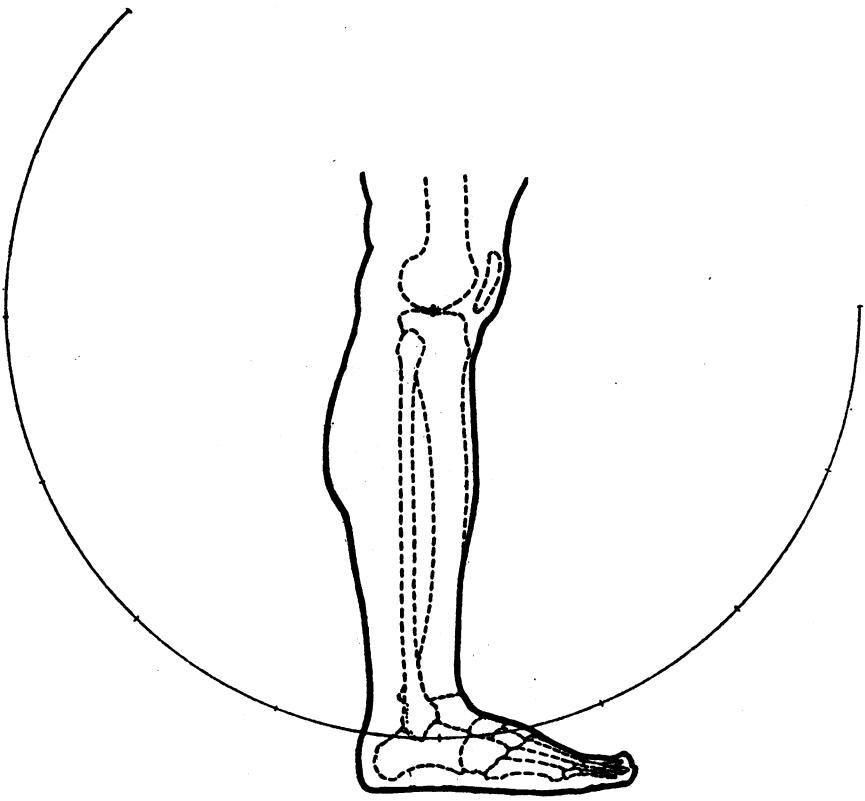


Observe the points of extreme forward and backward elevation (active) and mark these points with ink on the circumference of the circle in the diagram. Join these points with an ink line following the circumference of the circle, which will then indicate the full extent of active movement.

If it is considered desirable to indicate passive movement also, use another diagram in the same way, stating that it shows Passive movement.

Each subdivision of the circle represents 22½ degrees, or ¼ of a right angle.

FLEXION AND EXTENSION AT THE KNEE JOINT



Mark with ink on the circumference of the arc in the diagram the point of extreme flexion (active) and of extreme extension (active). Join these points with an ink line following the circumference of the arc, which will then indicate the full extent of active movement.

If it is considered desirable to indicate Passive movement also, use another diagram in the same way, stating that it shows Passive movement.

Each sub-division of the arc represents 22½ degrees or ¼ of a right angle.